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Effect of different sowing times on development and efficiency of some chinese cabbage varieties (*Brassica campestris* sbsp. *pekinensis*)

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Abstract

The aim of the study was to determine the effect of different sowing times on development and efficiency of some Chinese cabbage varieties (*Brassica campestris* sbsp. *pekinensis*) under Corlu conditions. The study was conducted in Corlu County which has a tougher climate than its Province Tekirdag where a similar research had been done before. The research was conducted in 2000 and three different sowing times (15 August, 15 September and 15 October) and four domestic varieties (Tokat-2, Tokat-5, Tokat-29 and Tokat-89) were used. The variety, Tokat-89 and the sowing time of 15 September were found to be the most suitable variety and sowing time, respectively, The variety and time of sowing recorded superiority for head weight, level of hardness and head quality.

Key words: Chinese cabbage (*Brassica campestris* sbsp. *pekinensis*), sowing times, development, efficiency

Introduction

Chinese cabbage is a vegetable which is widely grown and pleasingly consumed in the East Asian Countries; especially in China, Japan, Korea and Taiwan, and which is also very well adapted to the cool climate conditions (Vural *et al.,* 2000). When it is eaten fresh and raw, it is crisper, fresher and easily digested than the other cabbage sorts. For a working man, 100 g of Chinese cabbage supplies the total of daily need for calcium, magnesium, and vitamin C while it also provides some other minerals and elements important for human nutrition (Eryilmaz and Varis, 1996).

Since, Chinese cabbage has a short vegetation period as 2-2.5 months; it can be grown as the second crop after harvesting of cereals. By using the region's advantage of being closer to a metropolis as Istanbul, Chinese cabbage can be marketed in the same season as lettuce for which its production can be done as an alternative. Moreover, its production is suggested in between the growing periods of wheat and sunflower when the fields remain unused. Whether the results of the research conducted in Tekirdag Province in 1993 (Eryilmaz and Varis, 1994) can also be used for Corlu County which has a tougher climate was the objective of the research.

Materials and methods

The research was conducted in Corlu County of Tekirdag Province in 2000 under field conditions. The varieties, Tokat-2 (V_1), Tokat-5 (V_2), Tokat-29 (V_3) and Tokat-89 (V_4) well adapted to Tokat Region of the country, were used in the experiment and the seeds were obtained from Faculty of Agriculture; Gazi Osman, Pasa University, Tokat, Turkey.

The seeds of the varieties were sown as 2 seeds for each PE bags of which the closed dimensions were 15 x 15 cm and the thickness was 0.15 mm, black coloured in order to check moss growth and had bellows in order to stand upward, and under which there were drainage holes and which were filled in with peat. The sowings were done at the dates of 15 August (S_1), 15 September (S_2) and 15 October (S_3). The seedlings were planted in double lines on rows at 40x40 cm distances in the rows and on the rows respectively.

Production plan of the experiment

1st Sowing time	: 15 August
1st Planting time	: 16 September
Fertilizing	: 30 September
1st Harvesting time	: 22 October
Days from sowing to harvesting	: 67
2nd Sowing time	: 15 September
2nd Planting time	: 9 October
Fertilizing	: 24 October
2nd Harvesting time	: 14 December
Days from sowing to harvesting	: 94
3rd Sowing time	: 15 October
3rd Planting time	: 8 November
Fertilizing	: 23 November
3rd Harvesting time	: 18 January
Days from sowing to harvesting	: 94

Irrigation was supplied with a filtered bucket in the seedling period and in addition it was provided by furrow irrigation and raining irrigation with a hose in the development period. $(NH_4)_2SO_4$ 2% N was used for fertilization and it was supplied as 7 g m^{-2} (Eryilmaz and Varis, 1996). The experiment was set in a double recurrence and according to the experimental design of divided parcels.

The average temperature was 17.7 °C, the average rainfall was 44.3 mm, the average proportional humidity was 68.2 % and the average wind speed was 2.1 m s^{-1} during the experimental period (July-October).

The observations and analysis methods were as per Opena and Lo (1980) and Eryilmaz and Varis (1996). Head length (cm) was measured from the bottom to the top of the head. Head width was measued in the middle part of the head cut at length (cm). For

Table 1. The effect of sowing times on average head weight in some Chinese cabbage varieties (g)

Sowing Times	Tokat-2	Tokat-5	Tokat-29	Tokat-89	Main Sowing Effect
15 August	1070.0	1475.0	1326.5	1375.0	1311.6AB
15 September	1470.0	1532.0	1610.0	1600.0	1553.0A
15 October	1500.0	1200.0	1100.0	1300.0	1275.0B
Main variety effect	1346.6	1402.3	1345.1	1425.0	1379.8

LSD for Main Sowing Effect: LSD (*P*=0.01)=192.7

Table 2. The effect of sowing times on the ratio of tight head in some Chinese cabbage varieties (%)

Sowing Times	Tokat-2	Tokat-5	Tokat-29	Tokat-89	Main Sowing Effect
15 August	63.0	71.0	56.5	68.0	64.6A
15 September	62.0	58.0	57.5	43.0	55.1AB
15 October	51.5	60.0	43.0	60.0	53.6B
Main variety effect	58.8	63.0	52.3	57.0	57.7

LSD for Main Sowing Effect: LSD (*P*=0.01) = 11.2

number of leaves, all leaves were counted and averaged. For head weight plant head weight with outer leaves was measured after harvesting. Heading efficiency was calculated by dividing mean head weight with non-wrapper leaf weight.

For head tightness, all plants were observed and evaluated after each harvesting and they were explained as tight head, loose head and not forming head by (%). Hardness was determined by using following formula: Hardness (g cc^{-1}) = Average head weight head volume $^{-1}$. Where, Head volume (cc) = $0.524(d_1^2 d_2^{-1})$, d_1 = Average Head width (cm), d_2 = Average head length (cm).

Results and discussion

Head weight: Analyis of variance for testing effect of variety and sowing time on head weigh revealed that the mean sowing effect was significant at *P*=0.01 for head weight and sowing time of 15 September gave the plant with the heaviest head (Table 1).

Tight head: Analysis of variance indicated that the main sowing effect was significant at *P*=0.01 for the tightness of head. Consequently, the sowing time of 15 August gave the tightest head (Table 2). Tight head is an important factor for Chinese cabbage because of easy marketing (Gercekcioglu and Yazgan, 1989).

Loose head: Analysis of variance revealed that the sowing time was important for loose head formation. Thus, the sowing time of 15 October gave the plants having the loose heads.

Percentage of not forming head: The number of plants which did not form head was quite low. Hence, variance analysis was not realised. From the sowing time of 15 August, 7.4 % and from the sowing time 15 October 20 % of not forming head plants were obtained among the sowing times with respect to the averages. There was no significant difference within the varieties. However, Tokat-29 gave the highest percentage of not forming head plant (Table 4).

Hardness: The hardness of the varieties ranged from 0.39-0.42 (Table 3). The higher the hardness is, the tighter the head will be and this is a desirable property, because the paleness is attained later in plants with tight head. There was an excess weight in the plants which have smaller volume and they are comfortably and profitably marketed (Yazgan and Edizer, 1987). Moreover, a high value of hardness is advantageous for the producer, carrier, marketer and consumer due to enduring (Yazgan and Ece, 1990).

Table 3. Hardness in Chinese cabbage varieties

Variety	Hardness (g cc^{-1})
Tokat-2	0.39
Tokat-5	0.40
Tokat-29	0.40
Tokat-89	0.42

The results of the research are given as a whole in Table 4. For Corlu conditions; the variety of Tokat-89 and the sowing time of 15 September were determined as the most convenient variety and sowing time, respectively, regarding: head weight, level of hardness and head quality.

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Table 4. The results of the criteria analysed (S: sowing time; V: variety)

Treatment	Head length (cm)	Head width (cm)	Number of leaves	Head weight (g)	Seed forming head (%)	Tight head ratio (%)	Loose head ratio (%)	Not forming head (%)	Heading efficiency
S_1V_1	23.8	15.8	36	1070.0	0	63	37	0	21400
S_1V_2	22.0	18.3	30	1475.0	0	71	30	0	29500
S_1V_3	24.0	16.7	33	1326.5	0	56.5	43	0	26530
S_1V_4	23.2	15.9	30	1375.0	0	68	42	0	27500
S_2V_1	26.2	16.1	33	1470.0	0	62	38	0	29400
S_2V_2	24.3	16.7	35	1532.0	0	58	41	4	30640
S_2V_3	27.4	15.2	33	1600.0	0	43	43	11	32000
S_2V_4	28.2	16.4	34	1610.0	0	57.5	32	14	32200
S_3V_1	25.5	16.3	40	1500.0	0	51.5	30	18	30000
S_3V_2	22.8	15.8	42	1200.0	0	60	17	23	24000
S_3V_3	23.4	16.1	33	1100.0	0	43	20	35	22000
S_3V_4	25.2	15.2	38	1300.0	2	60	15	25	26000

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